

Investigation

3

Quadratic Patterns of Change

In previous units, you studied patterns in linear and exponential relationships. In this investigation, you will look for patterns in quadratic relationships as you solve some interesting counting problems.

What patterns of change characterize linear and exponential relationships?

What patterns of change did you notice in the quadratic relationships in Investigations 1 and 2?

3.1

Exploring Triangular Numbers

Study the pattern of dots.



Figure 1



Figure 2



Figure 3

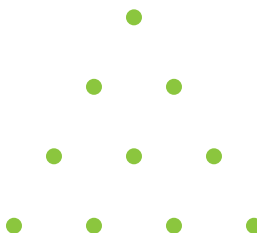


Figure 4

How many dots do you predict will be in Figure 5? In Figure n ?

The numbers that represent the number of dots in each triangle above are called **triangular numbers**. The first triangular number is 1, the second triangular number is 3, the third is 6, the fourth is 10, and so on.

Problem 3.1 Exploring Triangular Numbers

You can also represent triangular numbers with patterns of squares. The number of squares in Figure n is the n th triangular number.



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

- A.**
1. What is the sixth triangular number? What is the tenth triangular number?
 2. Make a table of (*figure number*, *triangular number*) values for the first ten triangular numbers.
 3. Describe the pattern of change from one triangular number to the next.
 4. Describe how you can use the pattern in the table to find the 11th and 12th triangular numbers.
- B.**
1. Write an equation for the n th triangular number t . In other words, write an equation for the number of squares t in Figure n . Explain your reasoning.
 2. Use your equation to find the 11th and 12th triangular numbers.
- C.**
1. Use a calculator to graph your equation. Show n values from -5 to 5 . Make a sketch of your graph.
 2. Does your graph represent the relationship you observed in the table? Explain.
 3. Does your equation represent a quadratic relationship? Explain.
 4. Compare this equation with the equations in Investigations 1 and 2.

ACE Homework starts on page 44.